# DIY

*Worthwhile projects you can build on your own*

## 6-band Windom antenna

Every so often, I get a request for an all-band HF antenna, and I'm not sure I know of such a design, except maybe a random wire with a super-duper tuner. Really good tuners are worth their weight in gold, but unfortunately most of them cost like they're made of it too. The object is to require only the tuner (3:1 SWR at best) internal to your radio, if yours has one.

It just so happens there's a good antenna that works well on six bands, and might fit the need for the most useful HF bands. In this case, **80-meters**, **40-meters**, **20-meters**, **15-meters**, **12-meters**, and **10-meters**. It's known as a ***Windom*** antenna, which is an OCF (off-center-fed) dipole with a twist. We discussed an OCF dipole in the June 2019 issue of the *UVARC Shack*, but it covered only four bands. The typical impedance of a Windom antenna (≈200 ohms) requires the installation of a 4:1 current balun, covered in the January 2020 issue of the *UVARC Shack*.

The Windom antenna differs from other OCF antennas because of a *center load*, which is designed to compensate for the impedance exhibited on 80 meters, and made from a capacitor and a snubber resistor. Because OCF antennas are notorious for conducting common-mode current, a *sheath current choke* is also added. Design credited to Serge Stroobandt ON4AA.

### Parts list

140 feet of 14 AWG stranded wire

Two toroidal FT240-31 ferrite cores

One 470 pF 15 kV doorknob capacitor

Ten 1730 snap-on 7 mm ferrite cores

One 1-½″ x 3/16″ eye bolt

One 4.7″ x 3.2″ x 2.6″ enclosure

One 1-3/8″ x 2-7/8″ fiberglass screen

Two #8 screws, wing nuts, washers, split washers

Hot glue and gun

One SO-239 bulkhead connector

80 inches of 18 AWG zip wire

One 1 M-ohm 1W resistor

14 inches 1″ heat shrink tubing

Eight 14 AWG #8 stud ring terminals

One 14 AWG #4 stud ring terminal

Crimp sleeves (optional)

4 each M3 screws, split washers, nuts

Super Glue™

Three dogbone insulators (you can fabricate these from ½″ PVC, about 3″ long each)

*Pair of FT240-31 toroids*

*Dogbone insulator*

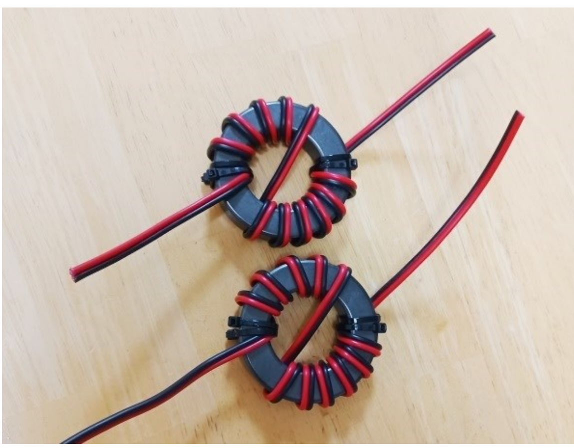
*Doorknob capacitor*

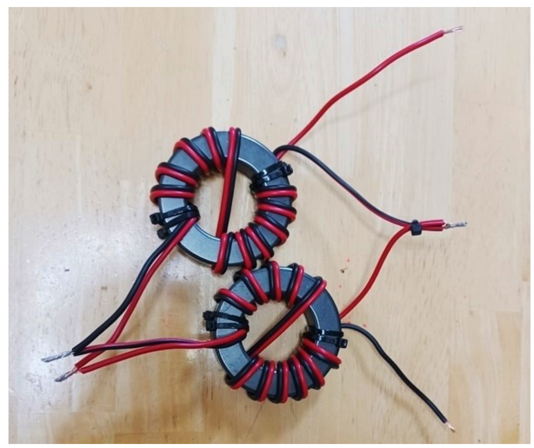
# DIY, continued

## *6-band Windom antenna*

### Construction

Let's start with the most difficult part, the *Guanella* 4:1 current balun, which begins with the toroids. No need to apply tape or any other covering over the toroids. Wind the two toroids identically, but with the red wire on the left for one, and the red wire on the right for the other, as in the photo. For each toroid, ***tightly*** wrap six turns of the wire pair on one side, then cross the pair over then under the diameter to wrap six more turns in the same direction, but on the other side of the pair. Zip-tie the two ends to secure them in place, leaving about four inches of wire pair on each end to work with, then strip all eight wire ends. (For reference, the ***transceiver end*** is on the left side in this photo, and the ***antenna end*** is on the right.)

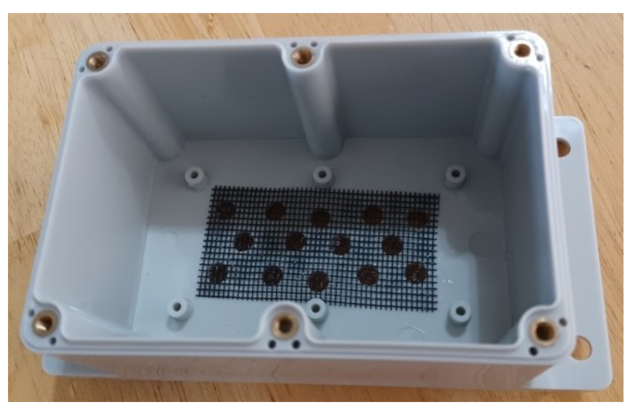




At the transceiver end, twist the two red wires together, and the two black wires together. At the antenna end, twist the black wire of one toroid with the red of the other toroid, solder them together, and cover the junction with small heat shrink tubing, if you want.

### Assemble the balun enclosure

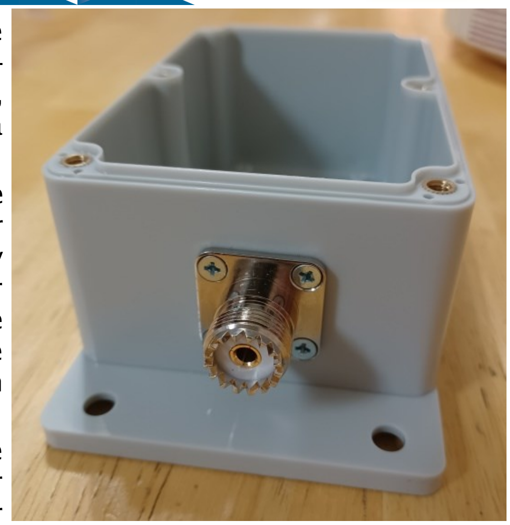
Drill twelve to sixteen ¼″ holes in the back of the enclosure, for ventilation. Cover the holes by super-gluing the fiberglass screen over them on the inside, to prevent insects and debris from entering the enclosure.



# DIY, continued

## *6-band Windom antenna*

Drill a ½″ hole in the enclosure at one end I'll call the ***balun bottom***. Place the solder end of the SO-239 bulkhead into the ½″ hole on the outside of the enclosure, and using the four mounting holes of the bulkhead as a template, drill a 1/8″ hole for each mounting hole.



Drill a 3/16″ hole in the ***balun top***, about 1-¼″ from the rear of the enclosure. Install a nut and then a flat washer onto a 3/16″ eyebolt, and slip the eyebolt assembly through the hole. Secure the eyebolt with a split washer and another nut. This eyebolt can be used to hang the balun and relieve some of the strain on the wire elements due to the weight of the balun, the sheath current choke, and the coax.

Zip-tie the two wired toroids together, one on top of the other. At the transceiver end of the wired toroids, solder the red pair to the center cup of the bulkhead. Solder the black pair to the #4 x 18 AWG ring terminal. Solder the red wire of the antenna end to a #8 x 18 AWG ring terminal, and the black wire to another. Assemble the bulkhead onto the enclosure using the M3-0.5 mm hardware, with the #4 ring terminal bolted to one of the screws.

Drill two 3/16″ holes on opposite sides of the enclosure near the balun top (the end opposite that of the bulkhead connector). For each side, install a #8 machine screw through a #8 ring terminal attached to one of the toroids, then through the 3/16″ hole from the inside. Install the washer and wing nut on the machine screw on the outside of the enclosure. Install the enclosure cover, and the balun construction is complete.

### The center load

Bend the leads of the snubber resistor around the doorknob capacitor, and solder them to a pair of #8 ring terminals. Bolt another #8 ring terminal to each capacitor terminal for the elements. Hot-glue the doorknob capacitor onto an unused dogbone insulator, and the center load construction is complete.

Most wire-type antennas made for 80 meters typically exhibit a relatively low bandwidth. The purpose of the center load is to broaden the bandwidth of the 80-meter antenna without sacrificing the other bands. It's placed in the very middle of the (entire) antenna because that's the location of lowest current for all signals of even harmonics. The end result is that it gives us a lot of room to play with.

# DIY, continued

## *6-band Windom antenna*

### Assembling the elements

Cut a 30-foot section of the 14 AWG wire. Slip one end through a crimp sleeve, through the left hole in the enclosure, then back through the same crimp sleeve. Install a #8 ring terminal on the wire after pulling it through the crimp sleeve. Secure the ring terminal to the left exposed terminal of the balun with a wing nut. Slip the other end through an unused dogbone insulator and tie it off at ***26 feet 4 inches***.

Cut a 42-foot section of the wire. Slip one end through a crimp sleeve, through the right hole in the enclosure, then back through the crimp sleeve. Install a #8 ring terminal on the wire after pulling it through the crimp sleeve. Secure this ring terminal to the right exposed terminal of the balun with a wing nut. Slip the other end of the 42-foot wire through another crimp sleeve, through a hole of the dogbone insulator of the center load, then back through the crimp sleeve, making this the left side of the center load.

Install a #8 ring terminal on the wire after pulling it through the crimp sleeve, such that the length of the wire between the crimp sleeve at the right side of the balun and the crimp sleeve on the left side of the center load is ***40 feet 9 inches***. Pull a 70-foot wire through a crimp sleeve, through the right side of the center load, and back through the crimp sleeve, then install a #8 ring terminal on it and bolt the terminal to the right side of the center load. Slip the other end through an unused dogbone insulator and temporarily tie it off at ***67 feet 7 inches***.

### The sheath current choke

Straighten a two-foot end of a 50-foot-long RG-8X coaxial cable that has been terminated on both ends with PL-259 connectors. Snap ten ferrite beads onto the coax jacket, as close to each other as possible. Slip the heat shrink tubing over all ten beads and heat-shrink the tube. You'll want to dedicate this coax to this antenna project, or any other that requires a sheath current choke.

The most common source of RFI (radio frequency interference) that occurs with OCF dipole antennas is the induced RF current that flows back into your transceiver on the outer skin of the coax braid. In general, OCF antennas are prone to this effect because the coax is positioned asymmetrically with respect to the antenna elements.

While the Guanella current balun is designed to choke much of the common-mode current that causes RFI, its function is primarily for the impedance transformation process, so its effectiveness against the high-powered unbalanced current generated by an OCF dipole remains lacking, requiring this current choke.

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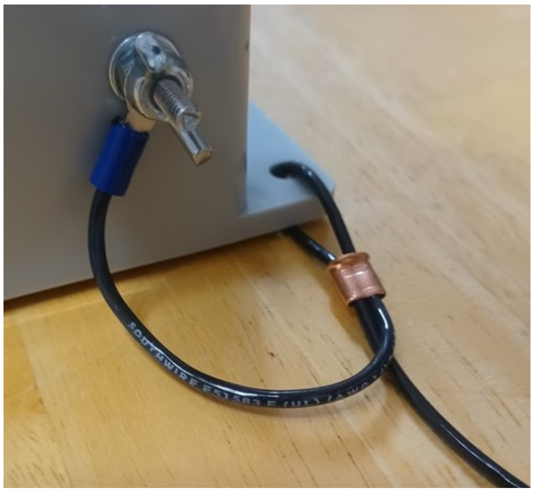
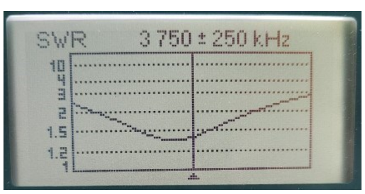
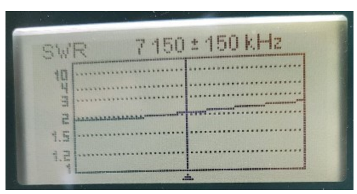


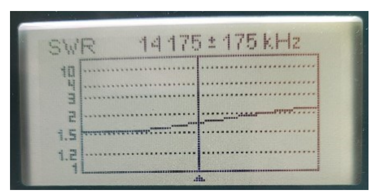
*Crimp sleeve and ring terminal* *The finished antenna and sheath current choke*

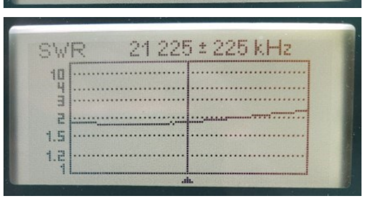
### Test time

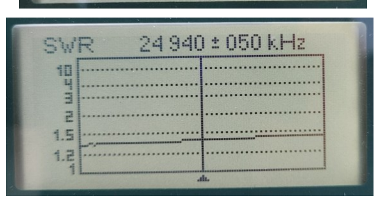
When it was time to check out the antenna, Kent Flowers N7EKF volunteered his help, which reduced the mount and test time considerably. This antenna is made to hang about 55 feet up, but we had the luxury of mounting it only 24 feet high. It turned out that all six bands were well within tuning range of an HF rig with an internal tuner, which can typically handle an SWR of 3.0:1 or lower.

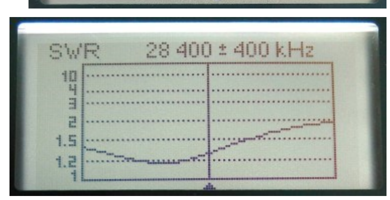



### Summary

Our Windom antenna supports six HF bands, the ones you're most likely to use. This particular design for the Windom antenna includes a balun, a center load, and a sheath current choke. The construction is somewhat straightforward for the most part, but can get involved in the transformer balun. This design is optimal if the antenna is mounted about 55 feet over the dirt, for average soil conductivity.

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